

# Maternal Recall Error of Child Vaccination Status in a Developing Nation

## ABSTRACT

In the absence of vaccination card data, Expanded Program on Immunization (EPI) managers sometimes ask mothers for their children's vaccination histories. The magnitude of maternal recall error and its potential impact on public health policy has not been investigated. In this study of 1171 Costa Rican mothers, we compare mothers' recall with vaccination card data for their children younger than 3 years. Analyses of vaccination coverage distributions constructed with recall and vaccination-card data show that recall can be used to estimate population coverage. Although the two data sources are correlated ( $r = .71$ ), the magnitude of their difference can affect the identification of the vaccination status of an individual child. Maternal recall error was greater than two doses 14% of the time. This error is negatively correlated with the number of doses recorded on the vaccination card ( $r = -.61$ ) and is weakly correlated with the child's age ( $r = -.35$ ). Mothers tended to remember accurately the vaccination status of children younger than 6 months, but with older children, the larger the number of doses actually received, the more the mother underestimated the number of doses. No other variables explained recall error. Therefore, reliance on maternal recall could lead to revaccinating children who are already protected, leaving at risk those most vulnerable to vaccine-preventable diseases. (*Am J Public Health*. 1991;82:120-123)

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## Introduction

This paper investigates the validity of mother's recall of a child's vaccination status. Vaccination cards are used as the accurate count of vaccinations to determine the direction and magnitude of maternal recall error. Previous research carried out on vaccination recall focused on American parents remembering their own vaccinations, rather than those of their children.<sup>1</sup> In this paper we recommend against using mother's recall for EPI monitoring and point out the importance of workable vaccination card programs.

## Methods

During early 1987, a representative sample of 1680 households with children younger than 3 years was taken in Costa Rica in order to measure health services coverage.<sup>2</sup> Trained interviewers used a pretested survey instrument to collect data. Costa Rica's successful vaccination card policy made feasible the use of these data for a comparison between recall and recorded data.

One child younger than 3 years was randomly selected from the household. The mother was asked to remember the number of doses of BCG, DPT, polio, and measles vaccine that child had received. (The interviewer used body sites and local names for drugs.) Afterward, the vaccination card was requested and vaccination dates were recorded. Up to 11 vaccinations were included: 1 BCG, 4 DPT, 4 polio, and 2 measles.

Recall error was measured as the difference between the number of remembered vaccinations and the number of recorded vaccinations. Positive numbers indicated overestimation, which places children at risk by resulting in community health workers' failing to vaccinate children who still require additional doses. Underestimates result in the waste of resources by vaccinating children with unnecessary doses.

A total of 509 mothers were excluded from the study because they had lost the vaccination card, vaccination dates for

any dose were illegible or missing, or the mother refused to try to remember a child's status for any vaccine. Few differences were shown by *t* tests in which the 1171 included mothers and the 118 excluded mothers with recall data were compared on various demographic variables.

Children who had never had a vaccination card were judged to have never been vaccinated, since Ministry of Health norms require a child to have or be given a vaccination card any time a vaccination is given.

## Results

### Vaccination Distributions

Distributions of the number of doses from the vaccination cards and from maternal recall are similar (Spearman's  $r = .65$ ; see Figure 1). This suggests that in the absence of vaccination cards, maternal recall can be used as a valid estimate of coverage of the EPI program in Costa Rica. Both sources of data indicate a successful program. A conclusion of policymakers in this circumstance could be to continue the existing EPI program. However, the important public health question remains: Can maternal recall be used to identify an individual child at risk for vaccine-preventable disease?

### Child Vaccination Status

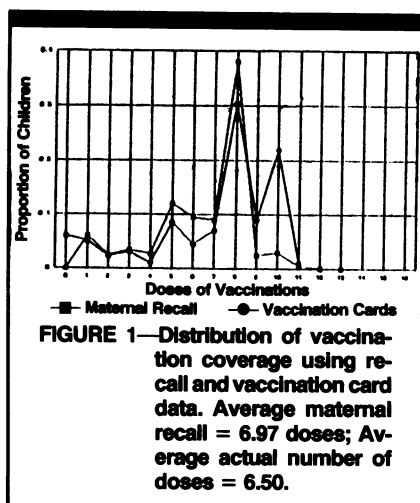
The two data sources are correlated on an individual level (Spearman's  $r = .71$ ) and the average difference is small, but large differences occur for some children (Table 1). Fourteen percent of the mothers mis-estimated by three or more doses. Thus, although maternal recall can be a

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**TABLE 1—Summary of Differences between Number of Doses Received and Maternal Recall of Vaccinations (n = 1171)**

	Percentage of Mothers	Maximum Recall Error
Overestimates	17	10 doses
Underestimates	37	8 doses

Note. Average recall error = -.47 doses.

valid estimate of coverage, it should not be used to determine an individual child's vaccination status.

Spearman's correlations between maternal recall error and potential explanatory variables are given in Table 2. Number of doses on the vaccination card and the child's age showed large negative correlations with recall error (Figures 2 and 3). The correlation with age is primarily an artifact, because mothers with very young children who received few doses cannot underestimate the number of doses. The negative correlation between recall error and actual doses has important implications. It suggests that mothers whose children are most at risk for vaccine-preventable diseases tend to overestimate their children's vaccinations. Mothers whose children are the least vulnerable tend to exhibit conservative preventive behavior by underestimating their children's coverage.

Further analyses show that the range of recall errors decreases as the number of contacts with community health workers increases (e.g., number of previous children, number of persons living in the household; see Figure 4). However, there is no relationship between frequency of contact with

**TABLE 2—Correlation Coefficients of Maternal Error about Child's Vaccination History and Covariates (n = 1171)**

	Mother's Memory Error
Number of doses from vaccination card	-0.61*
Mother's recall of doses	0.03
Annual community health worker visits	0.01
Traveling time from home to health center	0.02
Family recorded in health center records	-0.05
Child recorded in health center records	0.04
Number of persons living in house	0.08
Number of adults in house	-0.03
Number of adults in house who read and write	-0.03
Number of educated adults in house	-0.01
Mother's age	-0.01
Mother's education	-0.05
Number of children living in house	0.11
Age of child at time of interview	-0.35*
Months of residence in household	-0.05
Socioeconomic status	-0.04

\*P < .0001.

community health workers and the likelihood of overestimates relative to underestimates of vaccination status, and so frequency of contact with the health system does not explain recall error. Other variables exhibited no significant effect.

Reanalysis of the data excluding the 62 mothers who claimed never to have had a vaccination card for their child did not change the results.

### Type of Vaccination Regime

Cross-tabulations of maternal recall error against number of doses received are reported in Table 3 for each vaccination type. As with the overall results, the recall errors for measles, polio, and DPT vaccinations were inversely related to the actual number of vaccination doses. All of the mothers believed their children had received a BCG vaccination. Mothers whose children had received the vaccination remembered, but mothers whose children had not received it overestimated the number of doses.

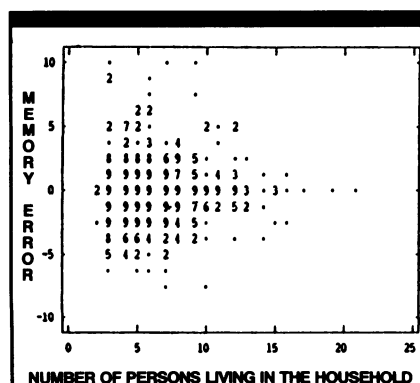
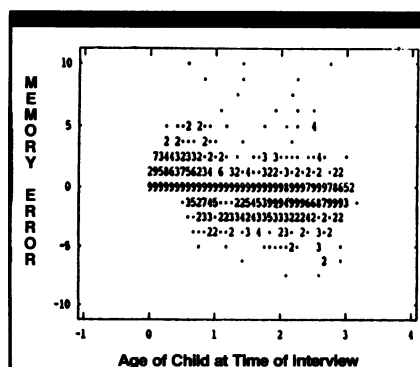
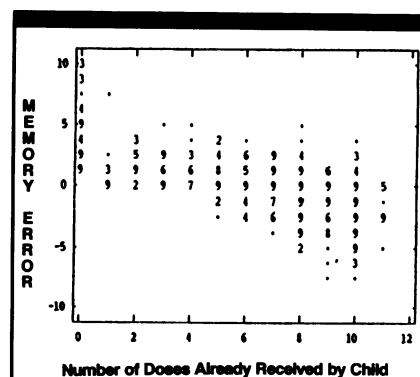


TABLE 3—Maternal Recall Error by Number of Doses Received for Four Vaccination Regimes

Error	Number of Doses					Total
4	3	2	1	0		
<b>DPT</b>						
4	0	0	0	0	1	1
3	0	1	0	0	9	10
2	1	1	1	3	11	17
1	5	11	7	10	11	44
0	86	365	106	83	85	725
-1	166	93	23	2		284
-2	32	41	2			75
-3	10	2				12
-4	3					3
Total	303	514	139	98	117	1171
<b>Polio</b>						
4	0	0	0	0	1	1
3	0	0	0	0	7	7
2	0	0	0	1	9	10
1	4	4	11	7	14	40
0	75	369	110	87	87	728
-1	164	105	22	3		294
-2	37	35	0			72
-3	14	2				16
-4	3					3
Total	297	515	143	98	118	1171
<b>Measles</b>						
4		0	1	0		1
3		0	1	0		1
2		0	8	5		13
1		1	36	57		94
0		24	623	293		940
-1		65	55			120
-2		2				2
Total		92	724	355		1171
<b>BCG</b>						
2			0	43		43
1			25	124		149
0			979	0		979
Total			1004	167		1171

Note. DPT  $\chi^2 = 350.4$ ,  $P < .001$ ; polio  $\chi^2 = 385.4$ ,  $P < .001$ ; measles  $\chi^2 = 303.3$ ,  $P < .001$ ; BCG  $\chi^2 = 1000.9$ ,  $P < .001$ .

## Discussion

A comparison of the number of vaccinations recorded in vaccination cards and the number recalled by mothers revealed important recall errors. Maternal recall error is correlated with vaccination frequency of the child. Whatever the ac-

tual number of doses, the recalled number of doses regresses toward the population average. The greater the frequency of contacts with the health system, the smaller the range of recall errors.

Although no data reported here explain the negative correlation, further re-

search should consider memory problems and the effect of social norms regarding vaccinations.

The results reported above suggest that relying on maternal recall of a child's vaccination history may result in erroneous decisions about whether to vaccinate the child. Children who are most at risk for vaccine-preventable diseases could be the most likely to remain unvaccinated, owing to their mothers' overestimation of doses received. Children who are least vulnerable, because of prior vaccination, are most likely to receive redundant vaccinations, owing to their mothers' underestimation. Nonetheless, maternal recall rather than vaccination cards can be used to estimate coverage.

As a result, EPI policies using recall data may have limited construct validity and thus ought to support the development of national vaccination card programs. Such a program's cost could potentially be offset by the savings resulting from not vaccinating children who already are up to date in their vaccinations. □

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## References

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